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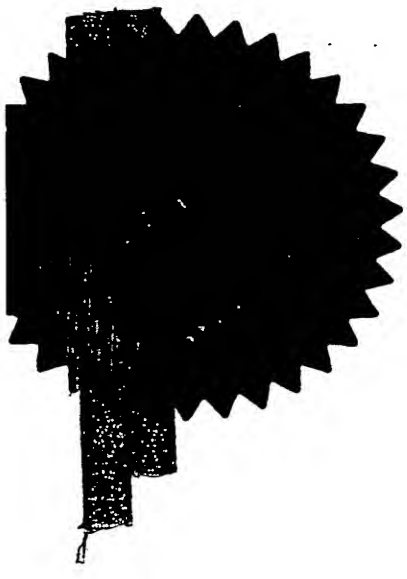

Signed Stephen Hordley

Dated 21 October 2003

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1. Your reference — HL81815/001

2. Patent application number *(The Patent Office will fill in this part)* — 0229028.6

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

PANDROL LIMITED
63 Station Road
Addlestone
Surrey KT15 2AR
United Kingdom

Patents ADP number *(if you know it)* — 8526154001

If the applicant is a corporate body, give the country/state of its incorporation — United Kingdom

4. Title of the invention

METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO A RAILWAY RAIL SUPPORT

5. Name of your agent *(if you have one)* — Haseltine Lake

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

Imperial House
15-19 Kingsway
London
WC2B 6UD

Patents ADP number *(if you know it)* — 34001 ✓

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
GB	0224581.9	22 October 2002

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
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Yes

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Continuation sheets of this form	
Description	7
Claim(s)	5 CF
Abstract	1
Drawing(s)	8 + 8

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Priority documents	
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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

	Signature	Date
Haseltine Lake, Agents for the Applicants	Haseltine Lake	12 December 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Christine Fenlon	[020] 7420 0500

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METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO A RAILWAY RAIL SUPPORT

The present invention relates to a method of attaching a rail clip anchoring device to a railway rail support, such as a railway sleeper or baseplate.

At present cast iron rail clip anchoring devices, or "shoulders", are attached to rolled steel baseplates using separate fasteners, for example bolts and nuts, or by welding. However, owing to the large number of shoulder/baseplate assemblies that are required it is desirable in order to reduce costs to fasten the shoulder to the baseplate without the additional expense of a separate fastening component. For the same reason it is also desirable to keep machining of either the baseplate or the shoulder to a minimum. Similar problems arise with attaching shoulders to steel sleepers.

According to a first aspect of the present invention there is provided a method of attaching a steel railway rail support to a ductile iron rail clip anchoring device, which method comprises:

inserting a boss, extending from the bottom of a body of the anchoring device, into a hole passing through the support at a location on its surface at which the anchoring device is to be attached until the anchoring device body abuts the support surface; and

compressing the steel around the hole in a region on the support surface opposite to that on which the anchoring device body is located, while the anchoring device is held in place, so that the compressed steel flows plastically against the boss within the hole, until the force thereby applied to the boss brings

about elongation thereof, whereby the boss undergoes an elastic set which clamps the boss to the support.

This method is quick and simple and has the additional advantages that (a) there is no requirement for a separate fastening component, (b) there is no need to induce heat into either component, (c) there is no need to clean rust or scale from either component, and (d) the method can be performed with common metalworking tools. Furthermore, unlike methods which simply hold the shoulder in place, a shoulder and support joined using this method must undergo stress reversal before they can be separated.

Preferably, the boss is provided with at least one recess in its flank and the compressed steel also flows plastically into that recess. Desirably, the recess comprises a single non-helical groove extending around the boss. Alternatively, the flank of the boss may be provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

The step of compressing the steel around the hole is preferably performed by applying a penetrating tool, having a working face of desired shape, to the surface of the support opposite to that on which the anchoring device body is located until the tool has entered the sleeper surface for a desired distance. The penetrating tool may be shaped to allow the said elongation of the boss.

The step of inserting the boss into the hole in the support may be performed by supporting the anchoring device so that the boss extends upwardly and then lowering the support such that the boss passes through the hole.

Typically, the support will be provided with two such holes and the method will be carried out simultaneously with respect to both holes thereby to attach two anchoring devices to the support.

The or each hole may be punched into the steel support.

According to a second aspect of the present invention there is provided a rail clip anchoring device, for use with a method embodying the first aspect of the present invention, which device has an anchoring device body and, extending from the bottom of that body, a boss provided with at least one recess in its flank, the recess comprising a single non-helical groove extending around the boss.

According to a third aspect of the present invention there is provided a railway rail fastening assembly comprising a steel railway rail support, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device having an anchoring device body and, protruding from the bottom of that body, a boss which extends into a respective one of the said holes in the support, the boss of each anchoring device having an elastic set whereby the boss is clamped to the support, wherein the boss of at least one of the anchoring devices has at least one recess provided in its flank, the recess comprising a single non-helical groove extending around the boss. The boss may be provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

The profile of the or each groove is preferably substantially that of a buttress thread. 15. The or

each recess is preferably provided adjacent a free end of the boss.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1, 2 and 3 show in perspective respective simplified representations of a shoulder, a portion of a baseplate and a penetrating tool for use in a method embodying the first aspect of the present invention;

Figures 4 to 8 illustrate steps in a method embodying the first aspect of the present invention;

Figure 9 shows a typical groove profile used in a shoulder embodying the second aspect of the present invention; and

Figures 10 to 12 show views of a baseplate/shoulder assembly produced using a method embodying the first aspect of the present invention.

In a method embodying the first aspect of the present invention a ductile iron rail clip anchoring device, hereafter called a shoulder, is attached to a steel baseplate. A simplified representation of a shoulder 1 is shown in Figure 1. The shoulder 1 is a ductile iron casting and has a body 10 from which there extends a cylindrical elongate boss 11 provided around its flank with a plurality of grooves 12 spaced along its length, the first of the grooves 12 being adjacent to the free end 13 of the boss 11. The boss 11 may be of any length less than or equal to the thickness of the baseplate 2 to which the shoulder 1 is to be attached and can be of any cross-sectional shape, although for ease of manufacture a cylindrical cross-section is preferred.

A simplified representation of a portion of a rolled steel baseplate 2 to which the shoulder 1 of

Figure 1 may be attached is shown in Figure 2, the baseplate 2 having a throughhole 20 of cylindrical cross-section. Each baseplate 2 will have two such holes 20, preferably formed by punching through the baseplate 2, at locations corresponding to the desired positions of the respective shoulders 1 to be fastened to the baseplate 2. The baseplate 2 has a top face 2a and a bottom face 2b.

In a method embodying the first aspect of the present invention, as shown in Figure 4 firstly two shoulders 1 (only one shown throughout) are held in a fixture jig 4 (not shown in Figure 4) such that their respective bosses 11 extend upwardly. The baseplate 2 is then positioned, with its top face 2a facing downwards, as shown in Figure 5, such that the holes 20 therein slip over the bosses 11 and the top face 2a of the baseplate 2 makes contact with the respective bodies 10 of the shoulders 1. Using a press (not shown), for example a mechanical or hydraulic metal working press of around 200 ton (203.21 tonnes) capacity, a penetrating tool 3 is brought into contact with the bottom face 2b of the baseplate 2, as shown in Figure 6. As shown in Figure 3 the tool 3 is similar to a hollow punch, having a circular working face 30 and a void 31. The working face 30 of the tool 3 is chosen so as to be a little larger in diameter than the hole 20 in the baseplate 2 and in use is brought into contact with the region of the bottom face 2b of the baseplate 2 around the hole 20. As shown in Figure 7 the press forces the tool 3 against the bottom face 2b of the baseplate 2 until the shear strength of the baseplate material is exceeded, whereupon the working face 30 of the tool 3 penetrates the bottom face 2b for

a predetermined distance. As a result, steel in the region of the baseplate 2 where the tool 3 has penetrated flows plastically into the grooves 12 and exerts a compressive force against the flank of the boss 11 which acts in such a way that the boss 11 deforms, i.e. stretches. Since the boss 11 is constrained at one end by the body 10 of the shoulder 1 held in the fixing rig 4, the boss 11 can stretch only upwardly, towards the opening of the hole 20 in the bottom face 2b of the baseplate 2. The void 31 is provided in the tool 3 to allow for this to happen while the tool 3 is being pressed into the baseplate 2. The stretching of the boss 11 results in an elastic set in the boss 11, which remains after the penetrating tool 3 is backed off, and produces a restoring clamping force, similar to that provided by a bolt, which holds the shoulder 1 on the baseplate 2. This stress, acting normal to the baseplate surface 2a, must be overcome (reversed) before any load applied to the shoulder 1 can succeed in lifting the shoulder 1 from the baseplate 2. The assembled shoulder 1 and baseplate 2 are shown in Figures 8, 10 and 11. Retention of the shoulder 1 on the baseplate 2 is assisted by frictional resistance between the boss 11 and the baseplate material in contact with it, and by the steel forced into the grooves 12 in the boss 11 which is in shear at the interface between the boss 11 and the baseplate 2. Although Figure 1 and related Figures show a shoulder 1 having a plurality of grooves 12, a method embodying the first aspect of the invention could usefully employ a boss 11 without any grooves 12 or other recesses, in which case the clamping force between the shoulder 1 and baseplate 2 would not be as great. Preferably,

however, a boss 11 having a single, coarser groove may be used instead, as shown in Figure 12, and in fact such an arrangement is likely to be more effective than a plurality of grooves and would be easier to manufacture. Figure 12 shows a section through a baseplate 2, to which a shoulder 1 had been attached using a method embodying the first aspect of the present invention and has now been removed following cutting of the baseplate 2. An indent 22 left by the action of the penetrating tool 3 on the bottom face 2b of the baseplate 2 can be seen. A groove 12 having a modified buttress thread profile, where the direction of axial loading is opposite in direction to a normal buttress thread, is preferred, as shown in Figure 9. Typical values for the dimensions and angles of the groove 12 shown in Figure 9 are: a=6.96mm, b=4.00mm, c=1.70mm, d=1.20mm, e=0.50mm, A=87°, B=58° and C=35°.

CLAIMS

1. A method of attaching a steel railway rail support to a ductile iron rail clip anchoring device, which method comprises:

inserting a boss, protruding from the bottom of a body of the anchoring device, into a hole passing through the support at a location on its surface at which the anchoring device is to be attached until the anchoring device body abuts the support surface; and

compressing the steel around the hole in a region on the support surface opposite to that on which the anchoring device body is located, while the anchoring device is held in place, so that the compressed steel flows plastically against the boss within the hole, until the force thereby applied to the boss brings about elongation thereof, whereby the boss undergoes an elastic set which clamps the boss to the support.

2. A method as claimed in claim 1, wherein the boss is provided with at least one recess in its flank and the compressed steel also flows plastically into the said recess.

3. A method as claimed in claim 2, wherein the recess comprises a single non-helical groove extending around the boss.

4. A method as claimed in claim 2, wherein the flank of the boss is provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

5. A method as claimed in any preceding claim, wherein the step of compressing the steel around the hole is performed by applying a penetrating tool, having a working face of a desired shape, to the surface of the support opposite to that on which the anchoring device body is located until the tool has entered the support surface for a desired distance.

6. A method as claimed in claim 5, wherein the said penetrating tool is shaped to allow the said elongation of the boss.

7. A method as claimed in any preceding claim, wherein the step of inserting the boss into the hole in the support is performed by supporting the anchoring device so that the boss extends upwardly and then lowering the support such that the boss passes through the hole.

8. A method as claimed in any preceding claim, wherein the support is provided with two such holes and the method is carried out simultaneously with respect to both holes thereby to attach two anchoring devices to the support.

9. A method as claimed in any preceding claim, wherein the said hole or holes are punched into the steel support.

10. A method as claimed in any one of claims 1 to 9, wherein the said railway rail support is a railway sleeper.

11. A method as claimed in any one of claims 1 to 9, wherein the said railway rail support is a railway rail baseplate.

12. A method of attaching a steel railway support to a ductile iron rail clip anchoring device substantially as hereinbefore described with reference to Figures 4 to 8 of the accompanying drawings.

13. A rail clip anchoring device, for use with the method of any preceding claim, which device has an anchoring device body and, protruding from the bottom of that body, a boss provided with at least one recess in its flank, the recess comprising a single non-helical groove extending around the boss.

14. A device as claimed in claim 13, wherein the flank of the boss is provided with a plurality of such recesses.

15. A device as claimed in claim 13 or 14, wherein the profile of the or each groove is substantially that of a buttress thread.

16. A device as claimed in any one of claims 13 to 15, wherein the or each recess is provided adjacent a free end of the boss.

17. A rail clip anchoring device substantially as hereinbefore described with reference to Figure 1 or Figure 9 or Figure 12 of the accompanying drawings.

18. A railway rail fastening assembly comprising a steel railway rail support, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device having an anchoring device body and, protruding from the bottom of that body, a boss which extends into a respective one of the said holes in the support, the boss of each anchoring device having an elastic set whereby the boss is clamped to the support, wherein the boss of at least one of the anchoring devices has at least one recess provided in its flank, the recess comprising a single non-helical groove extending around the boss.

19. An assembly as claimed in claim 18, wherein the flank of the boss is provided with a plurality of such recesses.

20. An assembly as claimed in claim 18 or 19, wherein the profile of the or each groove is substantially that of a buttress thread.

21. An assembly as claimed in any one of claims 18 to 20, wherein the or each recess is provided adjacent a free end of the boss.

22. An assembly as claimed in any one of claims 18 to 21, wherein the said railway rail support is a railway sleeper.

23. An assembly as claimed in any one of claims 18 to 21, wherein the said railway rail support is a railway rail baseplate.

24. A railway rail fastening assembly substantially as hereinbefore described with reference to Figure 8, 10 or 11 of the accompanying drawings.

ABSTRACT

METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO RAILWAY RAIL SUPPORT

In a method of attaching a steel railway rail support (baseplate or sleeper) (2) to a ductile iron rail clip anchoring device (1) a boss (11), extending from the bottom of a body (10) of the anchoring device (1), is inserted into a hole (20) passing through the support (2) at a location on its surface (2a) at which the anchoring device (1) is to be attached until the anchoring device body (10) abuts the support surface (2a). The steel around the hole (20) in a region on the support surface (2b) opposite to that on which the anchoring device body (10) is located is compressed while the anchoring device (1) is held in place, so that the compressed steel flows plastically against the boss (11) within the hole (12), until the force applied to the boss (11) brings about elongation thereof, whereby the boss (11) undergoes an elastic set which clamps the boss (11) to the support (2). The boss (11) may be provided with at least one recess (12) in its flank, such that the compressed steel also flows plastically into the said recess (12). Preferably the recess comprises a single non-helical groove (12) extending around the boss (11). Alternatively, the boss (11) may be provided with a plurality of recesses, each comprising a non-helical groove (12) extending around the boss (11).

[Figure 8]

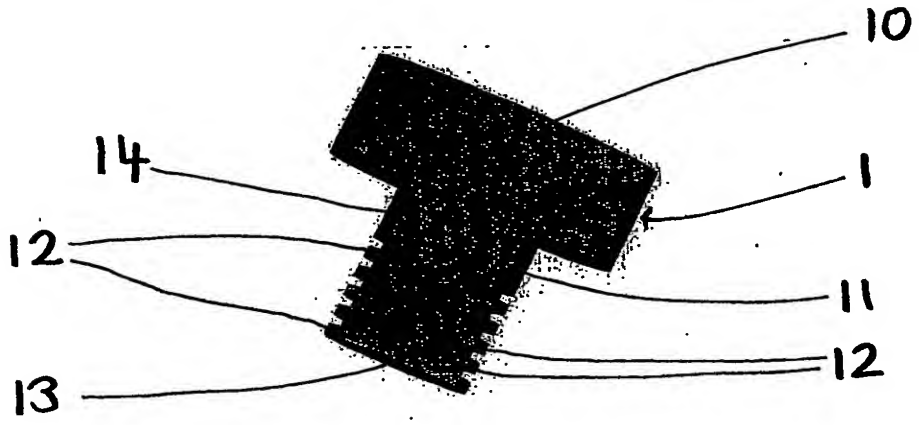

Figure 1

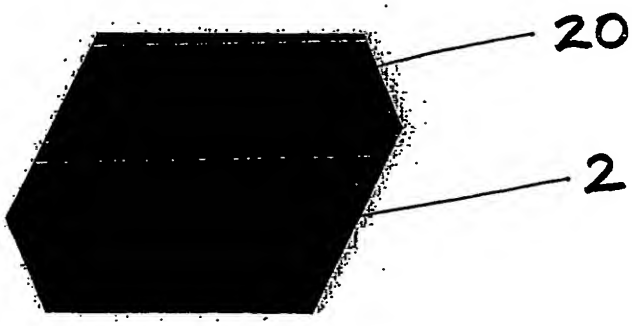

Figure 2

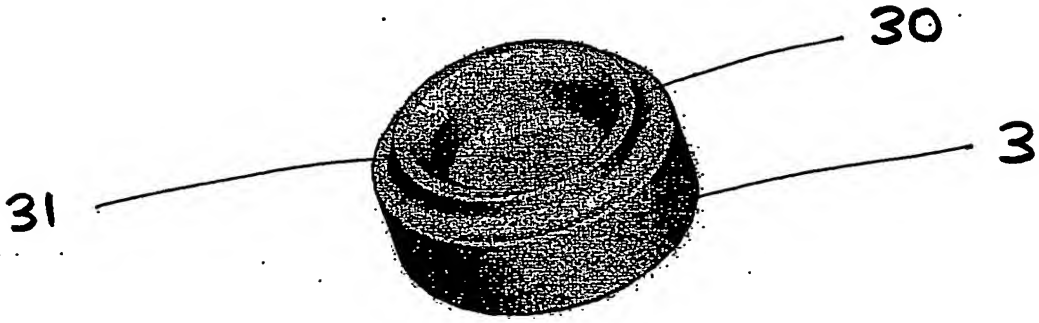

Figure 3

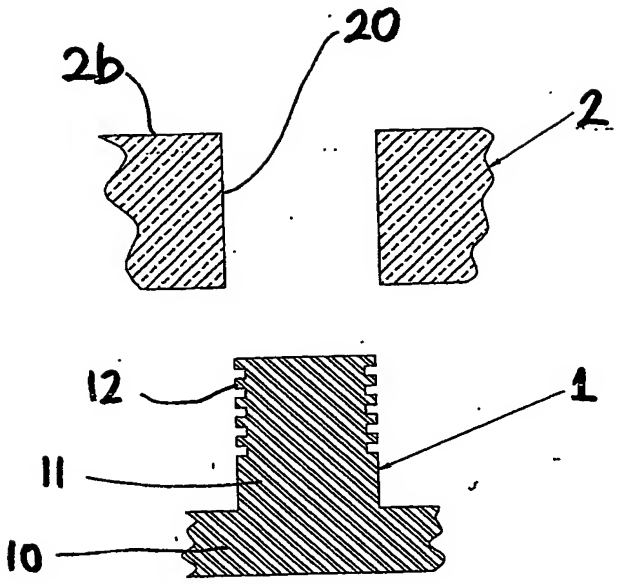

Figure 4

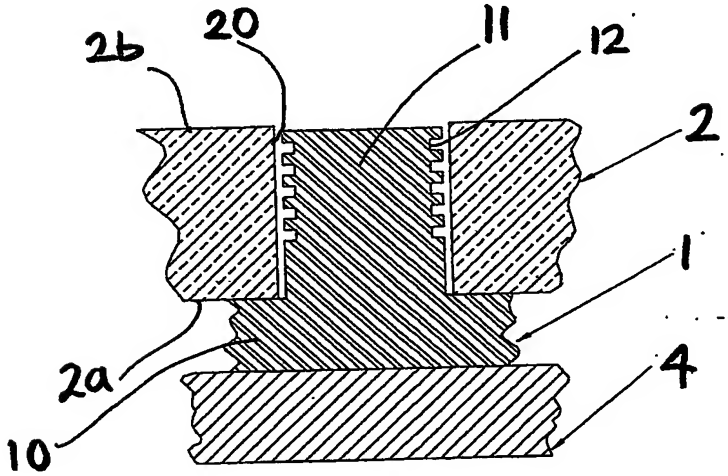

Figure 5

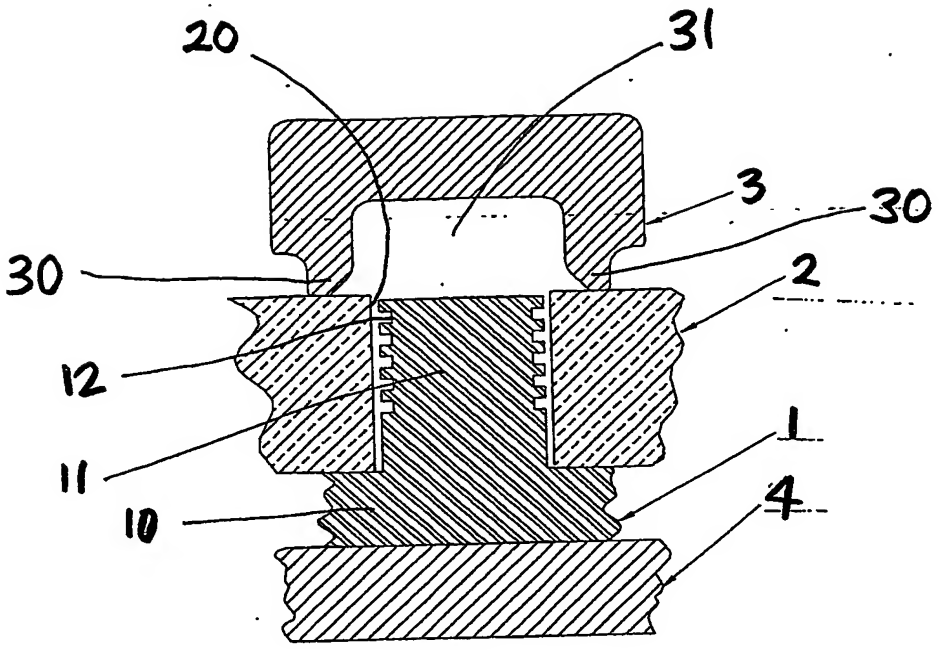

Figure 6

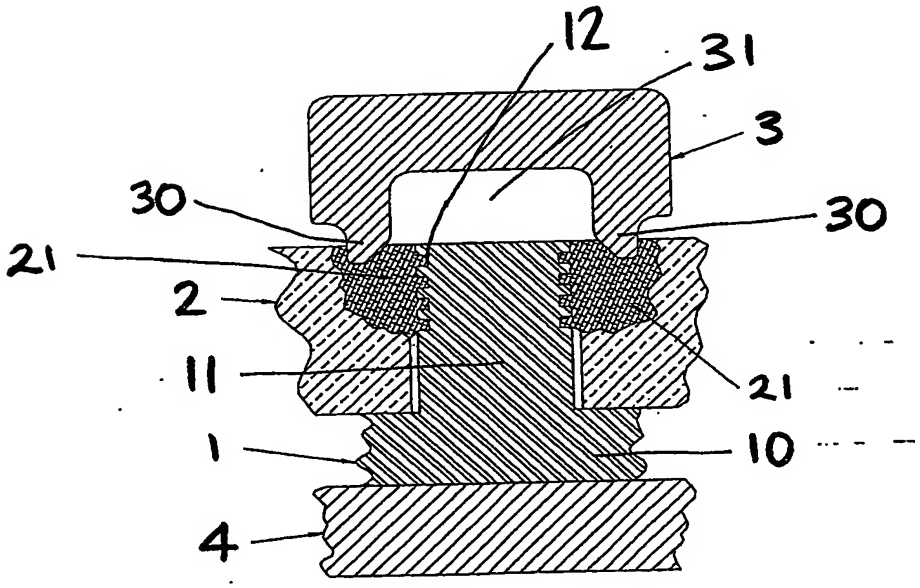

Figure 7

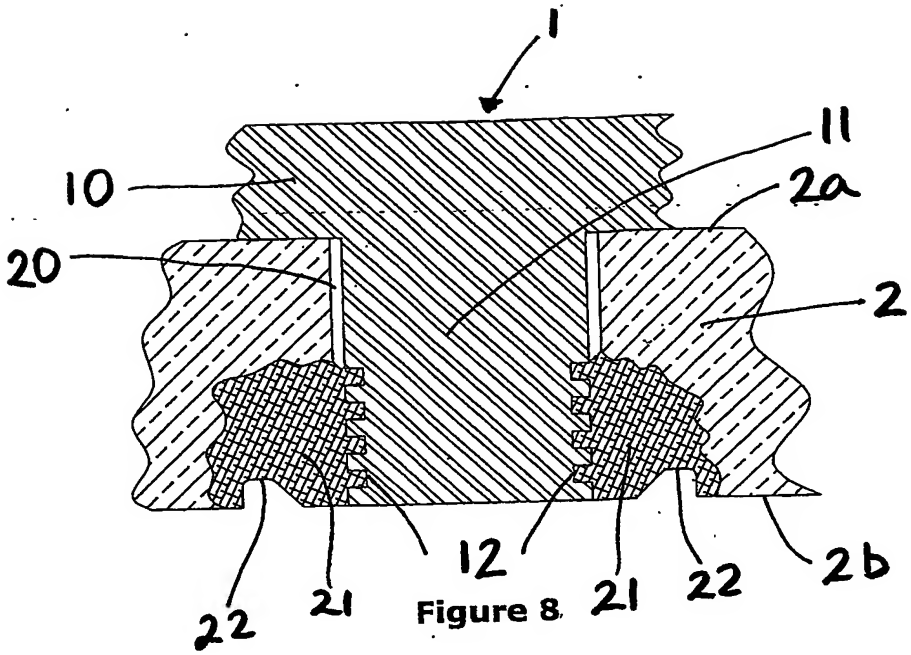

Figure 8

FIG. 9

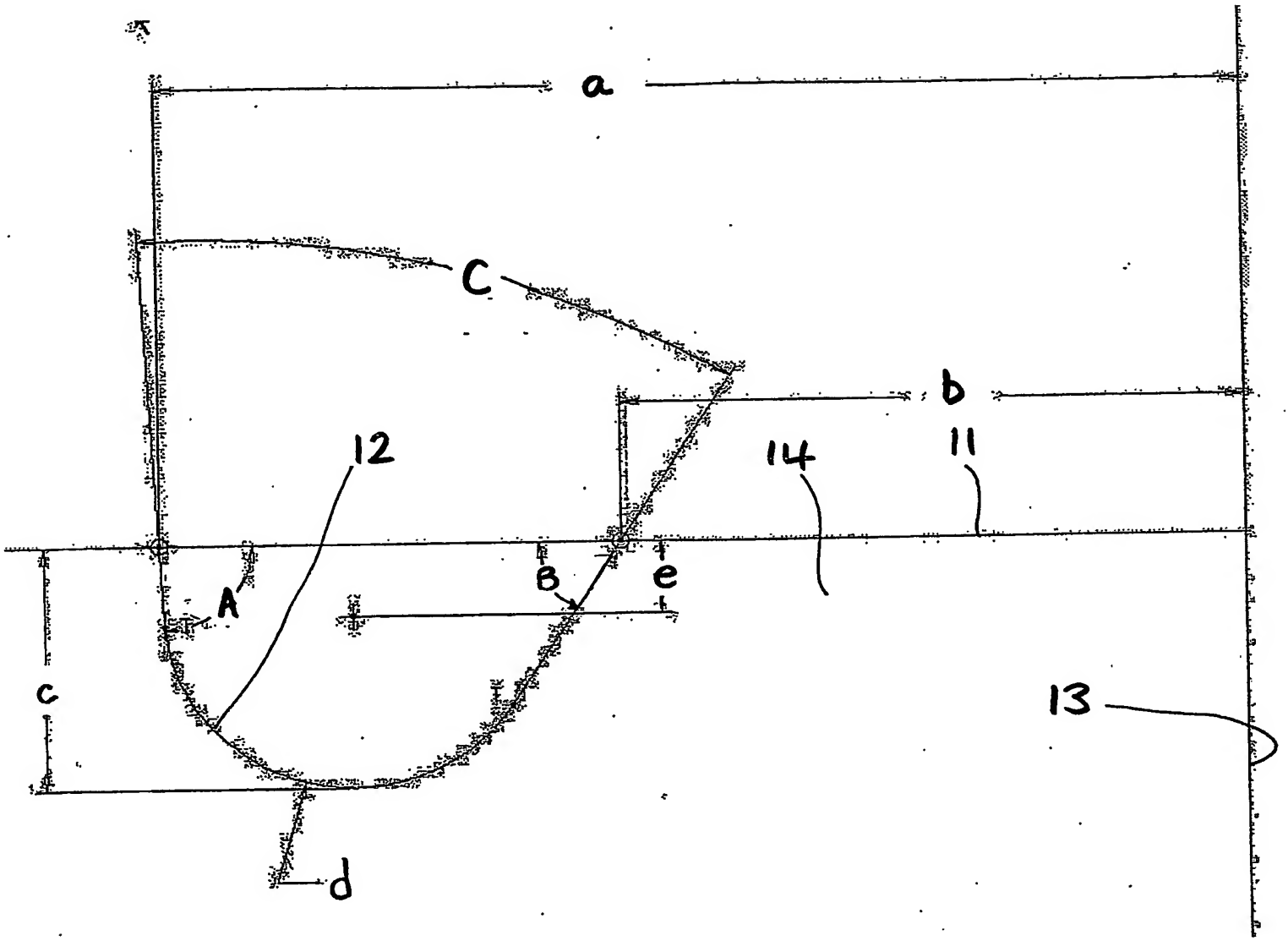

FIG. 10

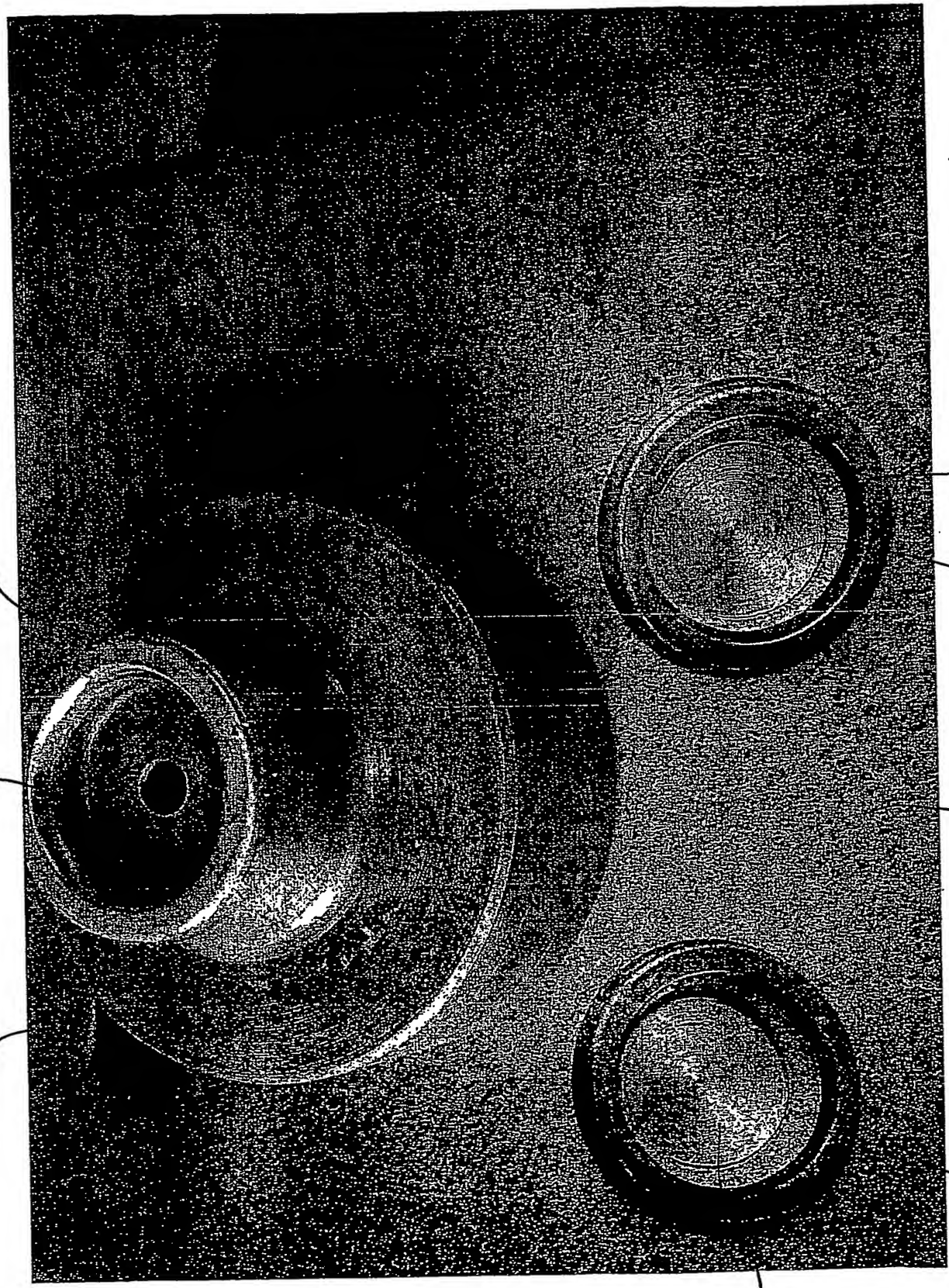

FIG. 11

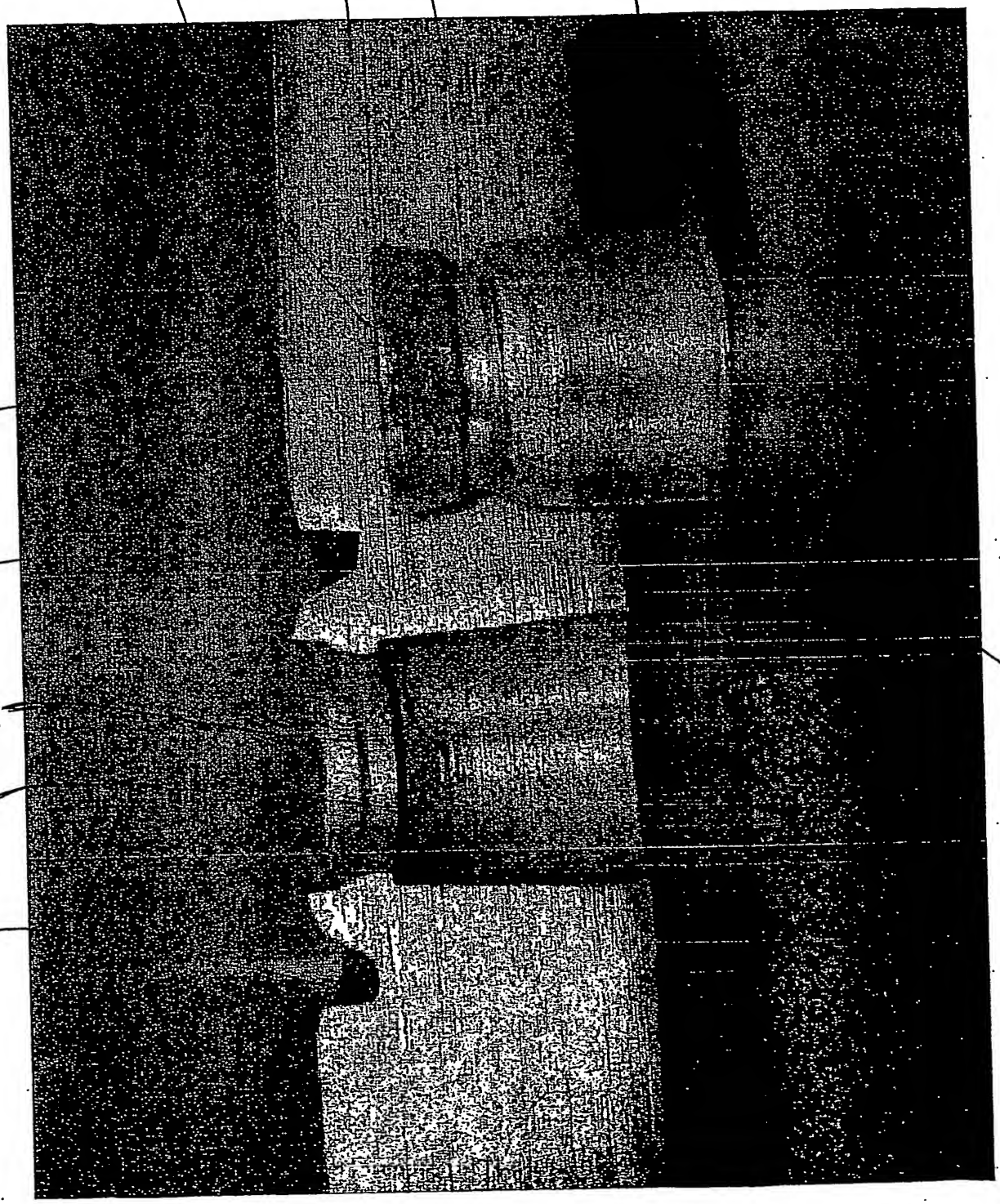

FIG. 12